

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

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1. REPORT DATE (DD-MM-YYYY)		2. REPORT TYPE Technical Papers		3. DATES COVERED (From - To)	
4. TITLE AND SUBTITLE				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER 2302	
				5e. TASK NUMBER MIG2	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Air Force Research Laboratory (AFMC) AFRL/PRS 5 Pollux Drive Edwards AFB CA 93524-7048				8. PERFORMING ORGANIZATION REPORT	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) Air Force Research Laboratory (AFMC) AFRL/PRS 5 Pollux Drive Edwards AFB CA 93524-7048				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S NUMBER(S)	
12. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution unlimited.					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT A	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON Leilani Richardson
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified			19b. TELEPHONE NUMBER (include area code) (661) 275-5015

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

36 separate files are enclosed

1122 038

MEMORANDUM FOR PRS (In-House Publication)

FROM: PROI (TI) (STINFO)

10 Aug 2000

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-TP-2000-163**
Liu, C.T., "Strain Rate Effect on Crack Opening and Growth in a Particulate Composite Material at Low Temperature"

3rd Conference on Mechanics of Time Dependent Materials (Statement A)
(Erlangen, Germany, 18-20 Sep 00) (Submission Deadline: 28 Aug 00)

1. This request has been reviewed by the Foreign Disclosure Office for: a.) appropriateness of distribution statement, b.) military/national critical technology, c.) export controls or distribution restrictions, d.) appropriateness for release to a foreign nation, and e.) technical sensitivity and/or economic sensitivity.

Comments: _____

Signature _____ Date _____

2. This request has been reviewed by the Public Affairs Office for: a.) appropriateness for public release and/or b) possible higher headquarters review

Comments: _____

Signature _____ Date _____

3. This request has been reviewed by the STINFO for: a.) changes if approved as amended, b.) appropriateness of distribution statement, c.) military/national critical technology, d.) economic sensitivity, e.) parallel review completed if required, and f.) format and completion of meeting clearance form if required

Comments: _____

Signature _____ Date _____

4. This request has been reviewed by PRS for: a.) technical accuracy, b.) appropriateness for audience, c.) appropriateness of distribution statement, d.) technical sensitivity and economic sensitivity, e.) military/national critical technology, and f.) data rights and patentability

Comments: _____

APPROVED/APPROVED AS AMENDED/DISAPPROVED

PHILIP A. KESSEL Date
Technical Advisor
Propulsion Science and Advanced Concepts Division



Strain Rate Effect on Crack Opening and Growth in a Particulate Composite Material at Low Temperature

C.T. Liu

Propulsion Directorate

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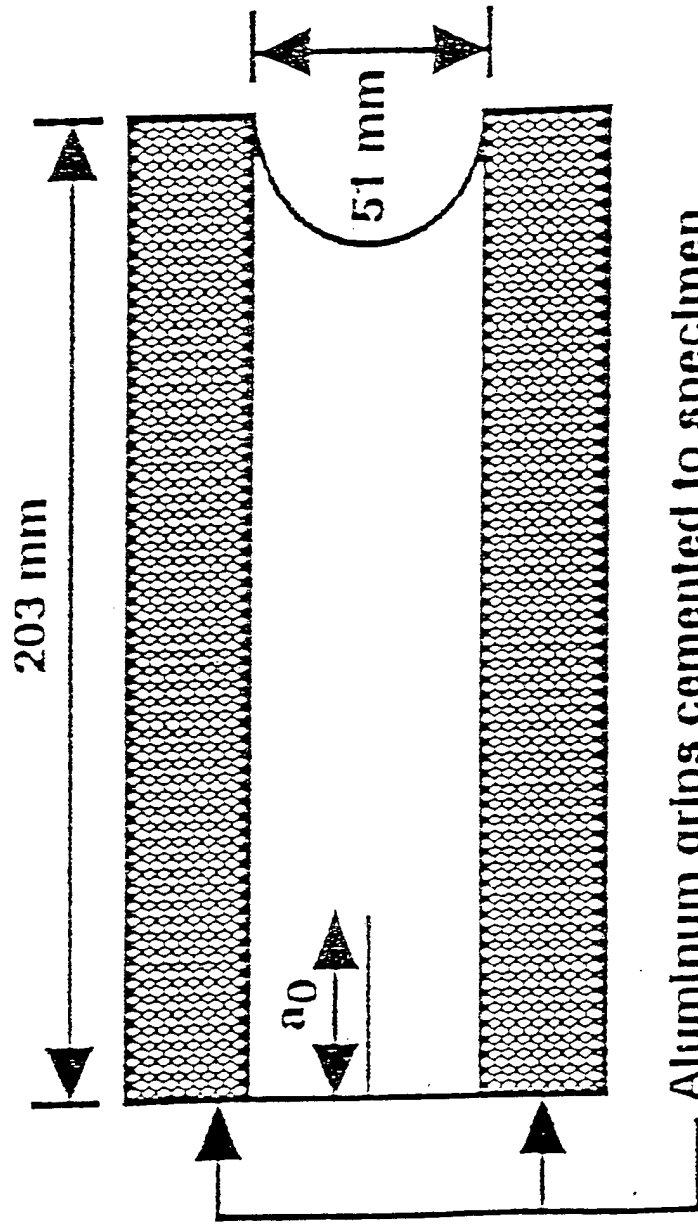
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Distribution A: Approved for Public Release



Objective

- Investigate the Effects of specimen thickness (2.54 mm and 12.7 mm) and Displacement Rate (2.54 mm/min and 12.7 mm/min) on Crack Opening Displacement, Failure process Zone, Local Strain Fields, and Crack Growth Behavior at Low Temperature.



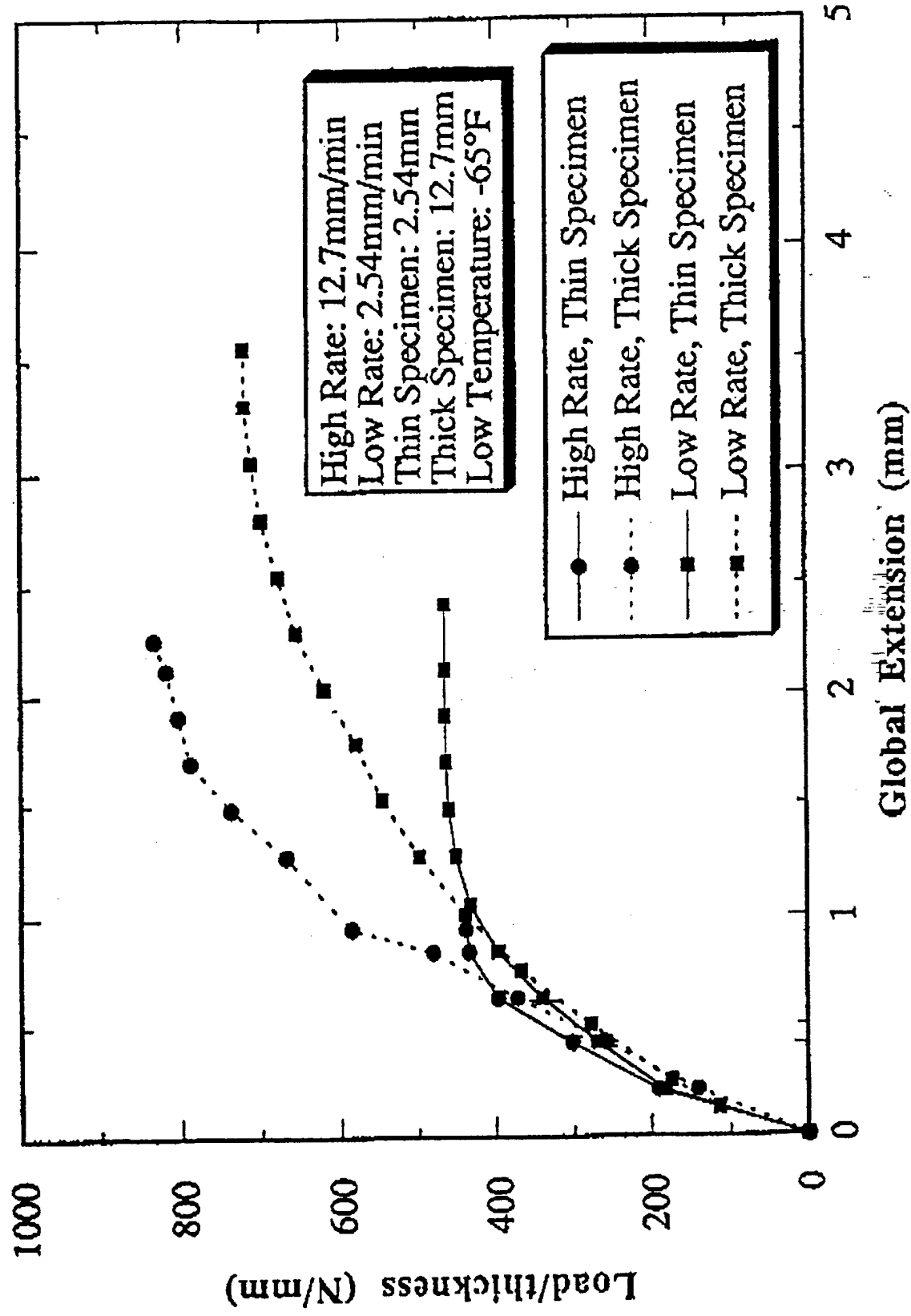
Aluminum grips cemented to specimen
Specimen thickness: 2.5 mm

$a_0 = 23\text{mm}$

Specimen Geometry

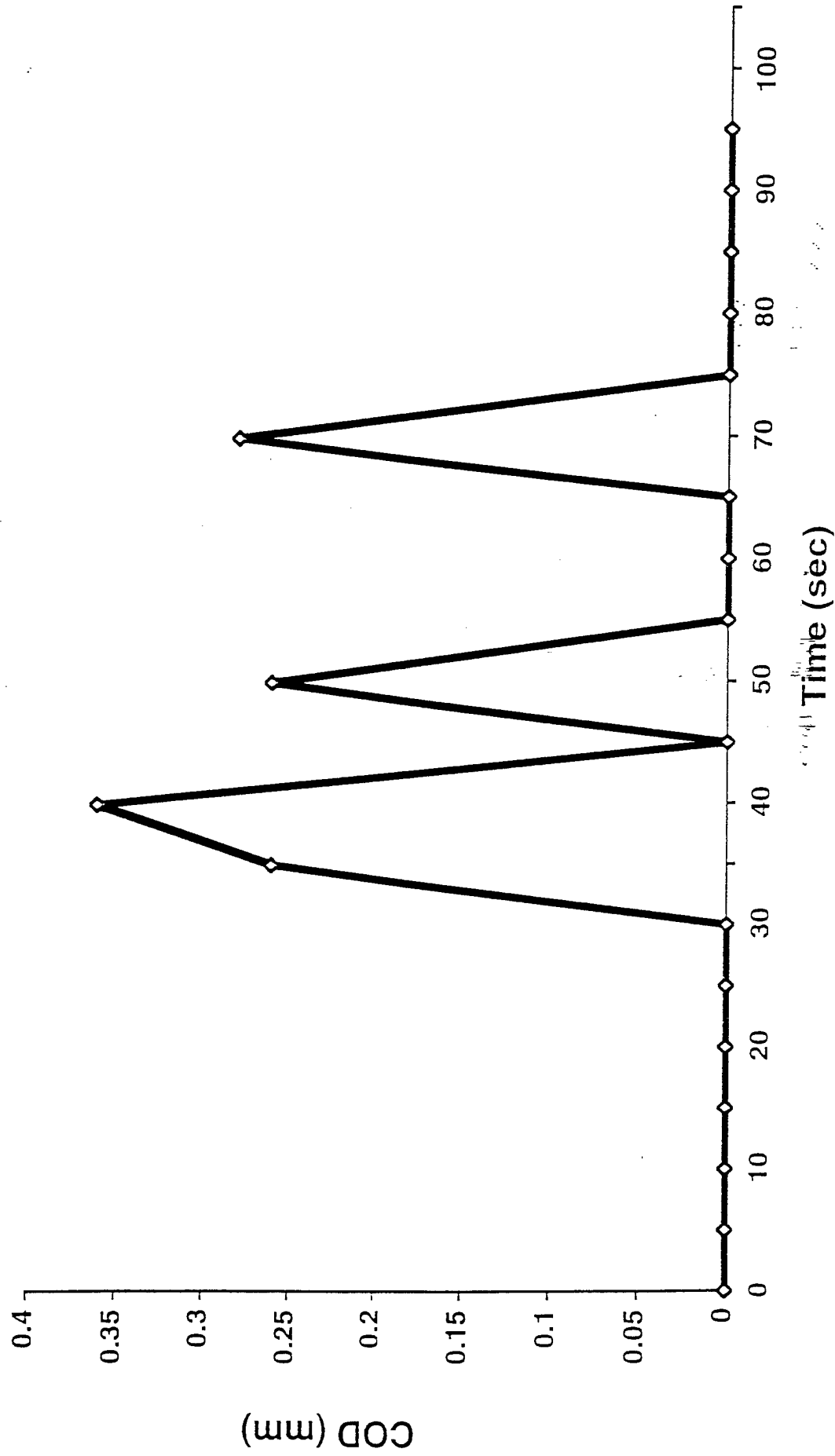


Load / Thickness vs. Global Extension



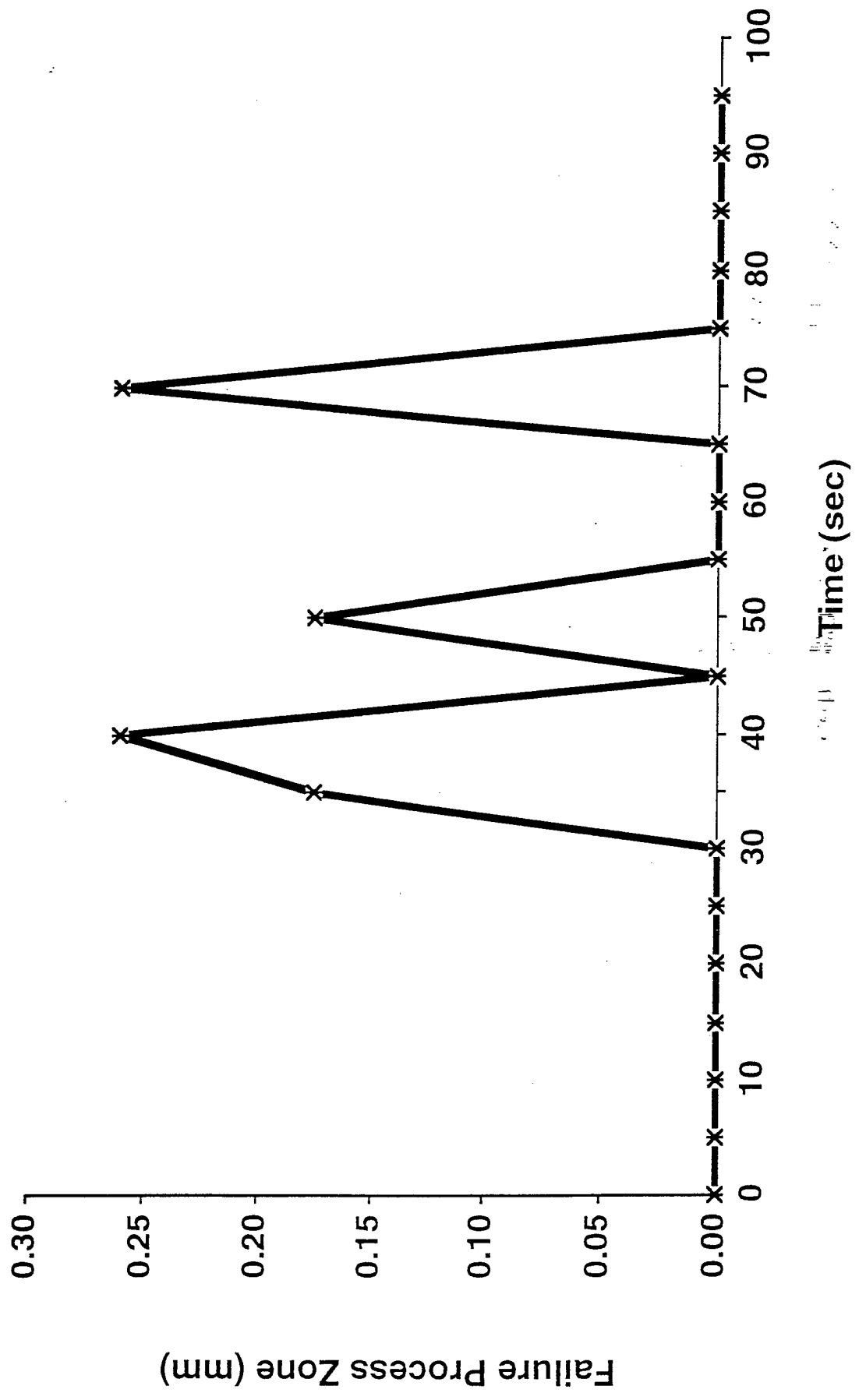


TKLRLT - COD vs. Time



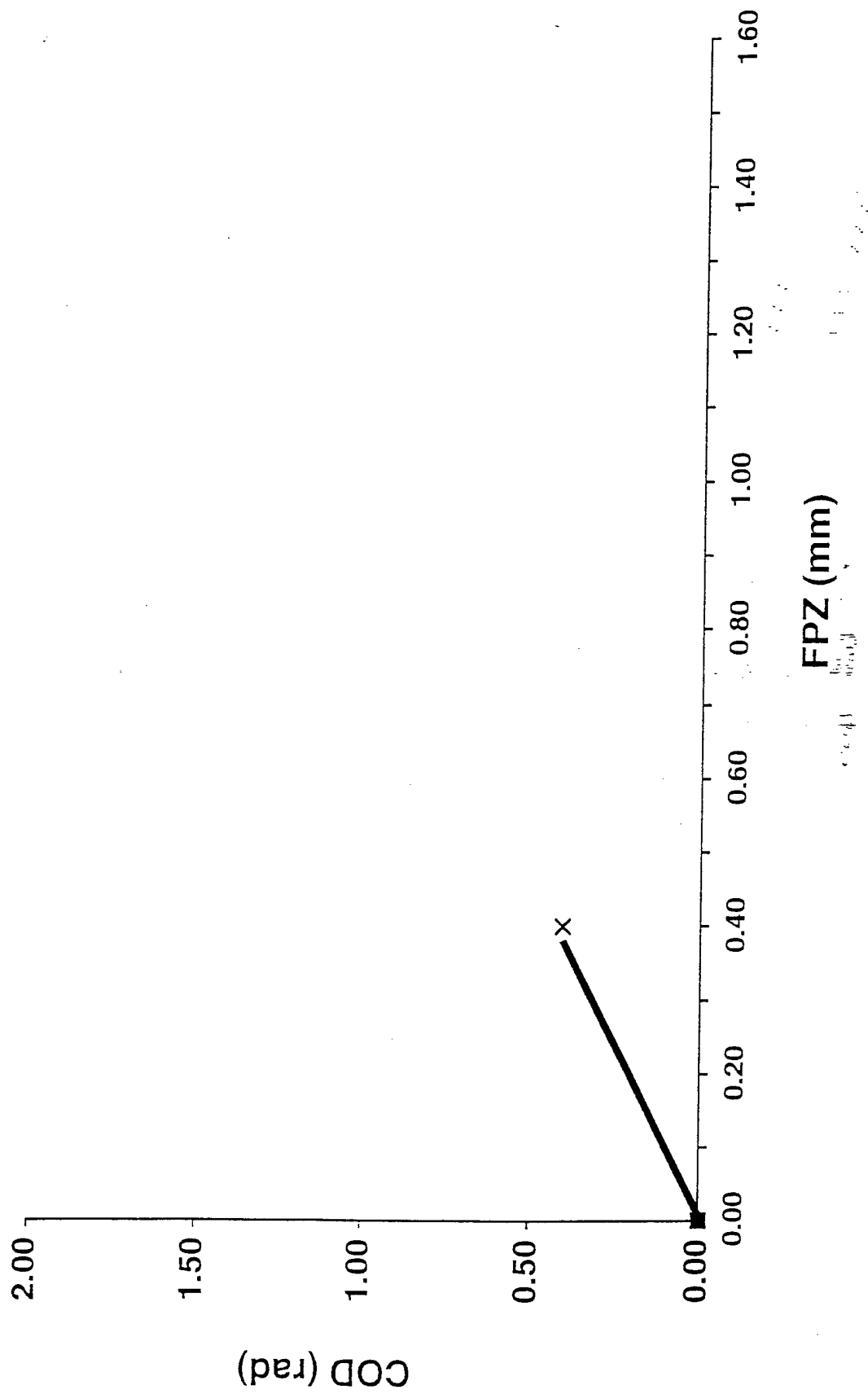


TKLRLT - Failure Process Zone vs. Time



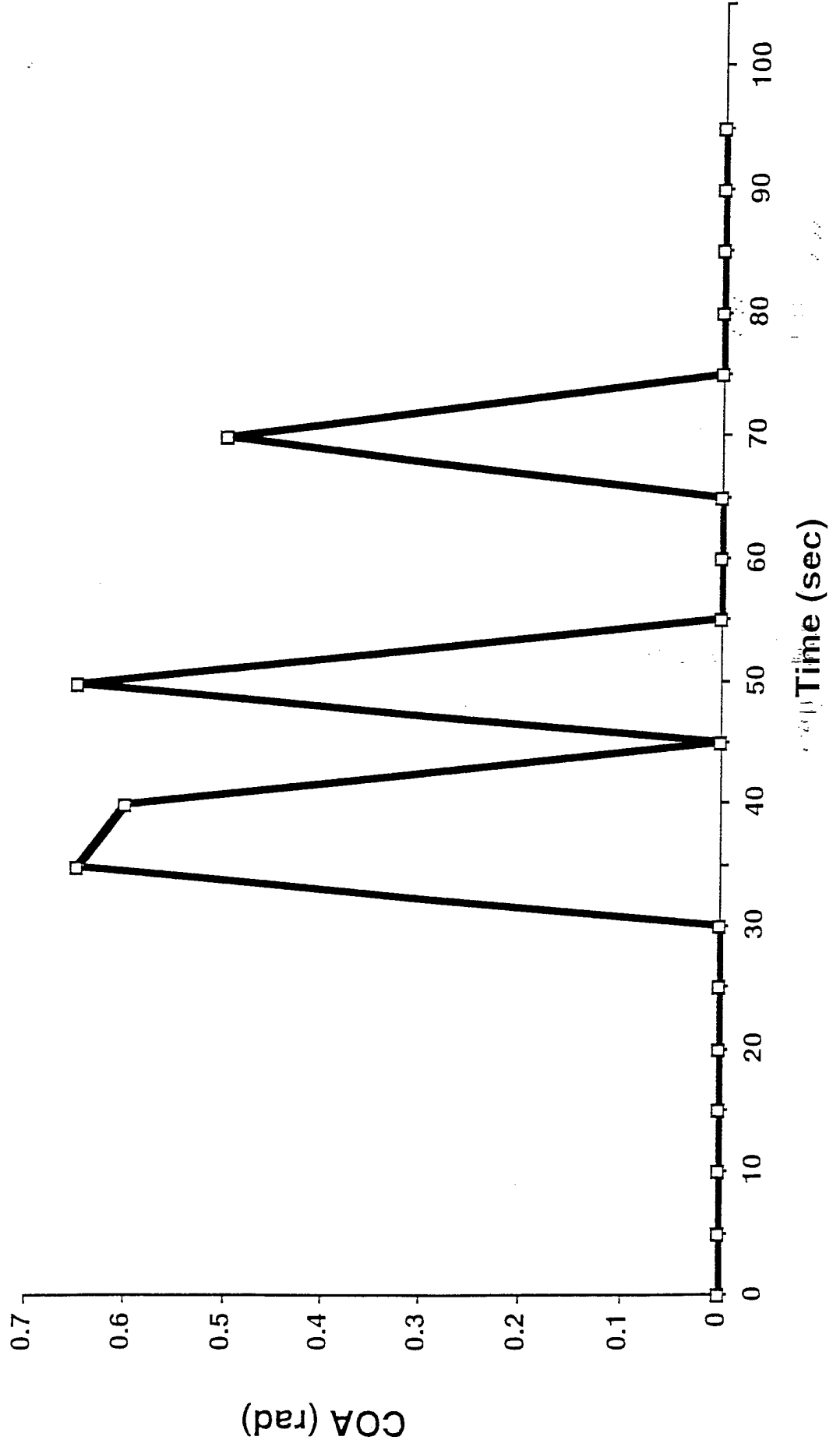


TKLRLT - COD vs. FPZ



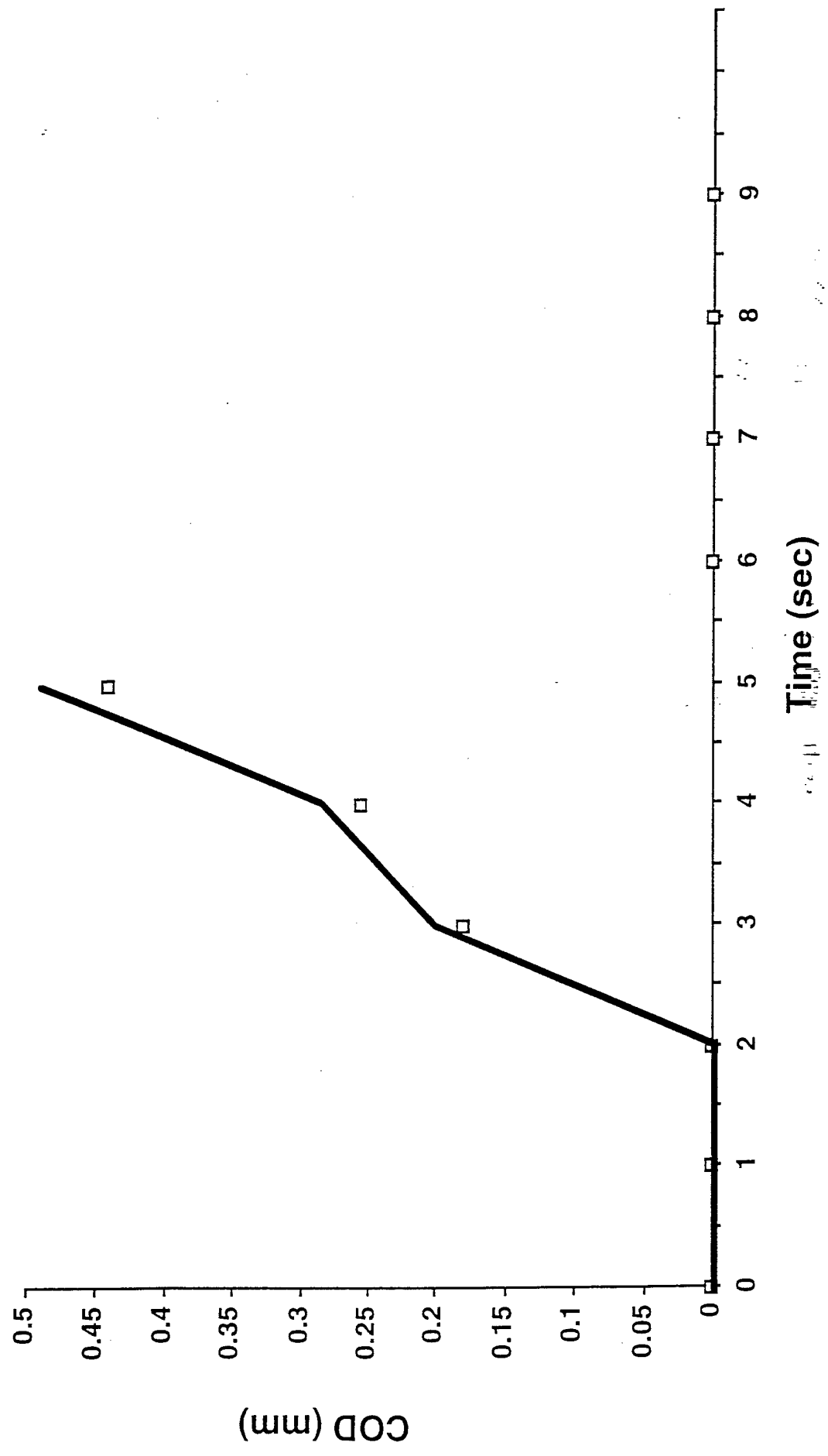


TKLRLT - COA vs. Time



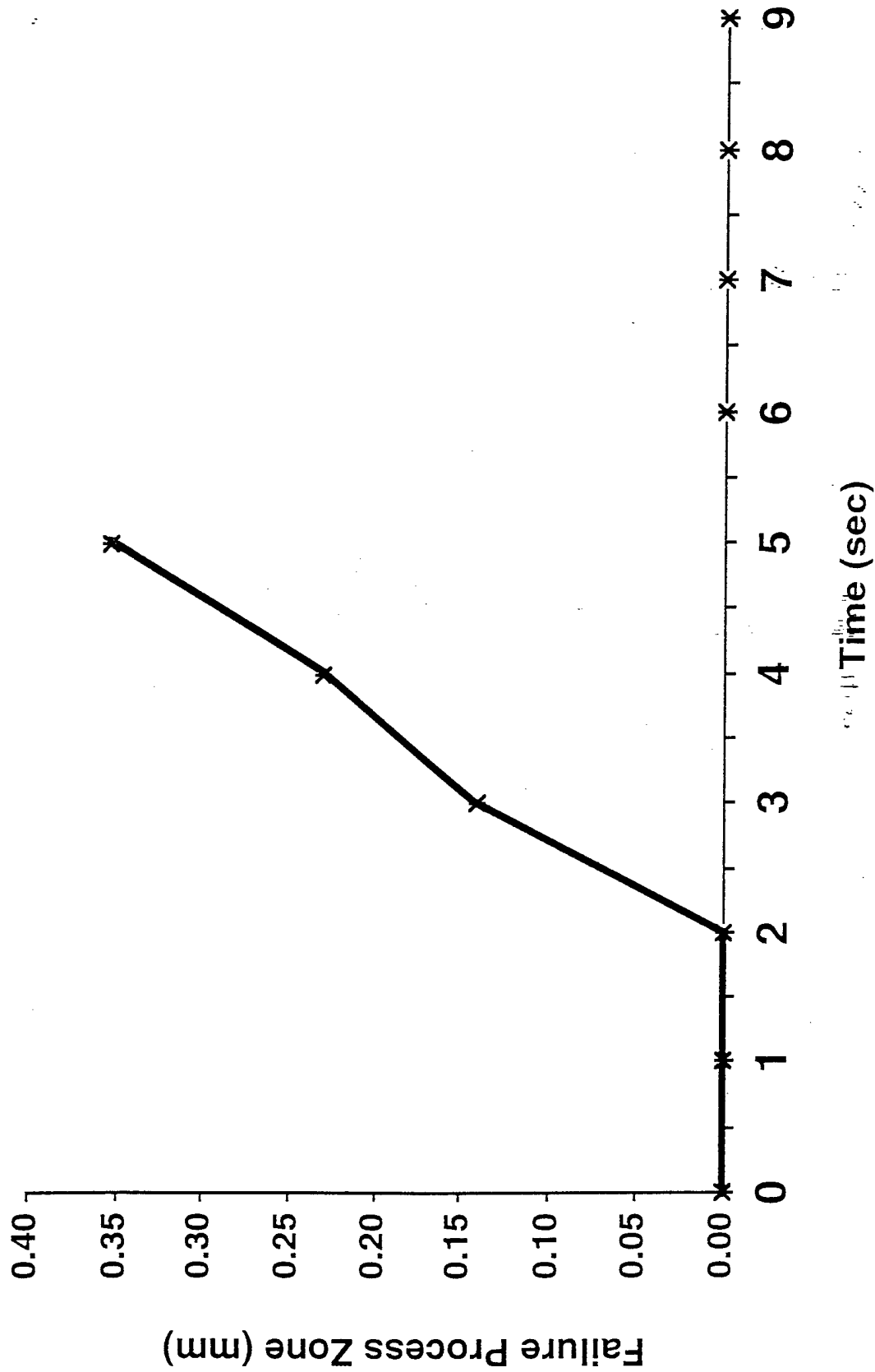


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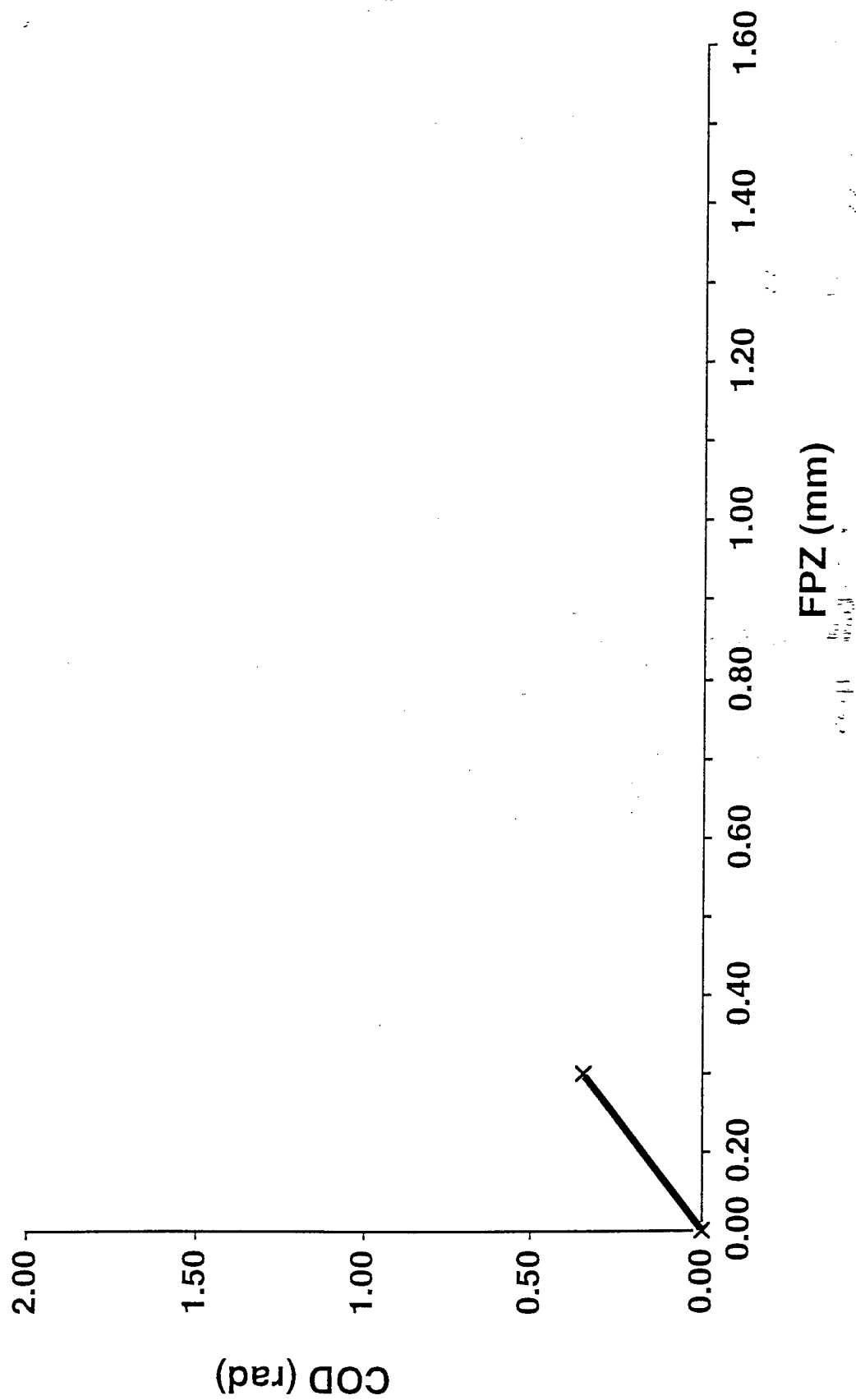


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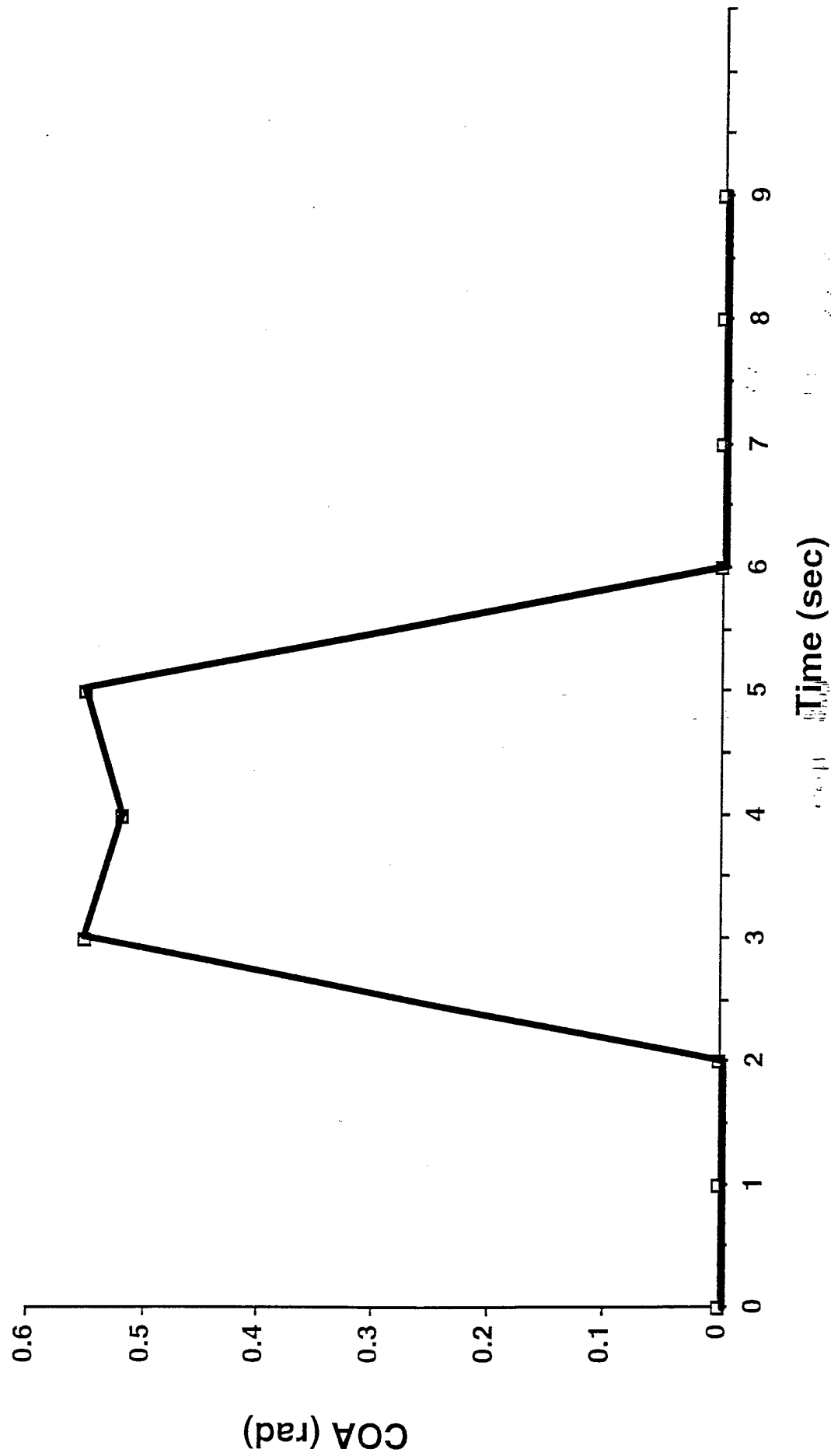


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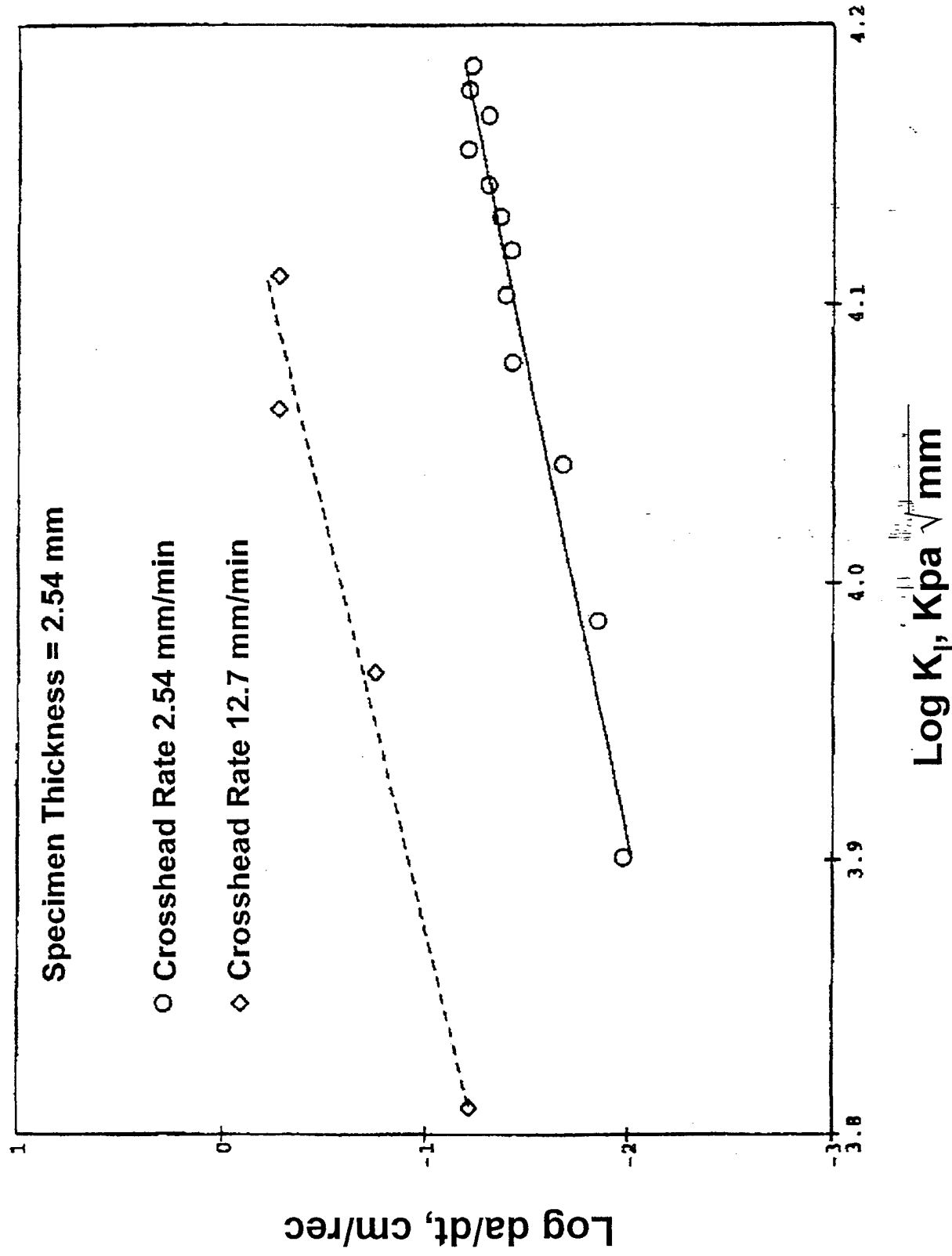


TKHRLT - COA vs. Time





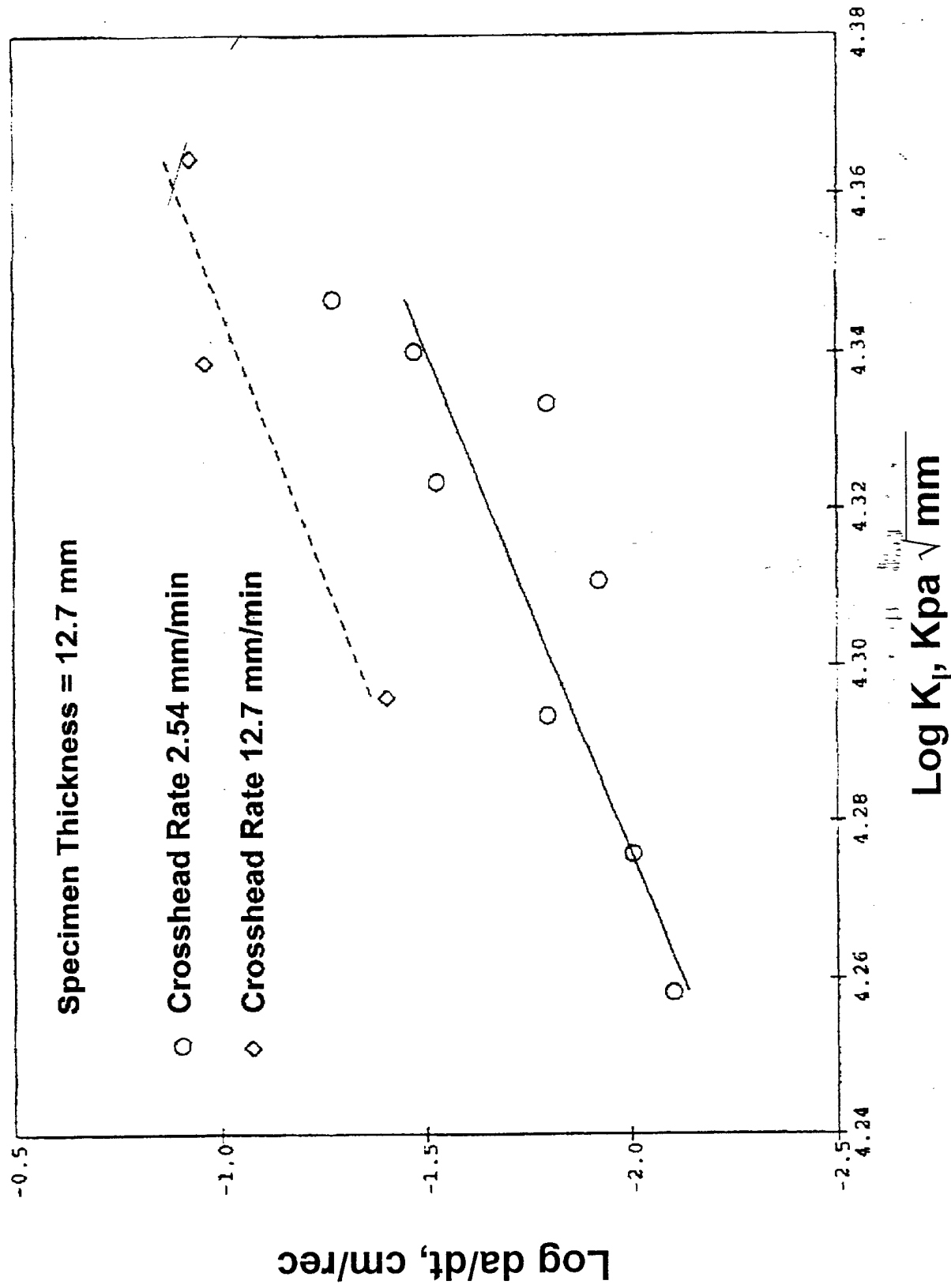
Crack Growth Rate vs. Mode I Stress Intensity Factor





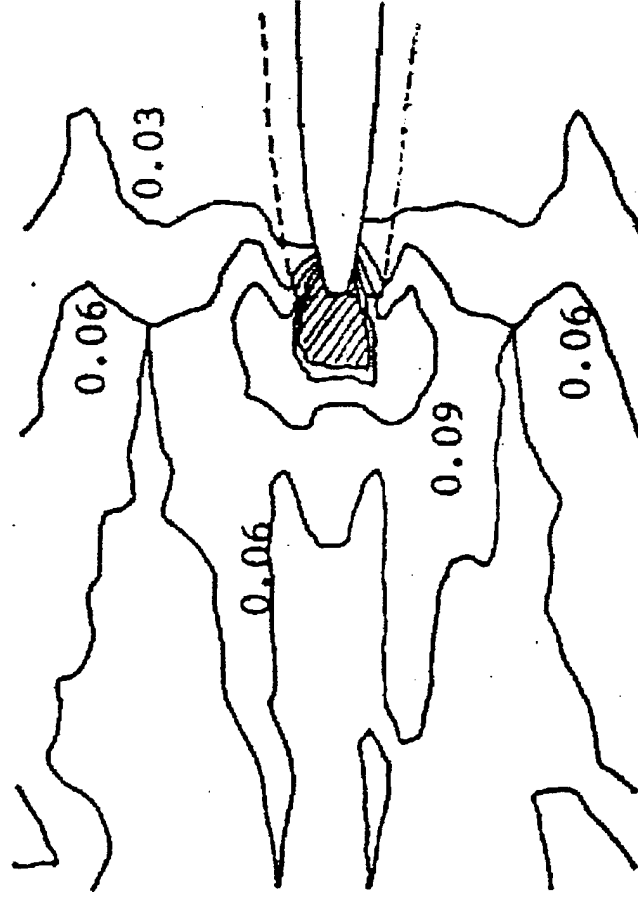
Crack Growth Rate vs. Mode I Stress Intensity Factor

A2130

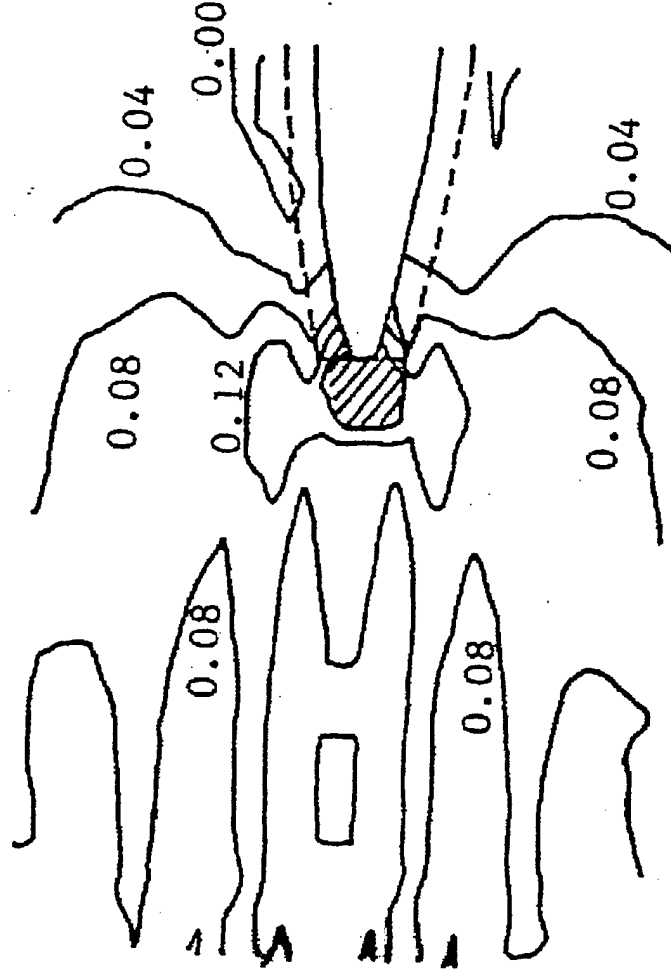




Iso - Intensity Strain Contours (thickness = 0.1 in.)



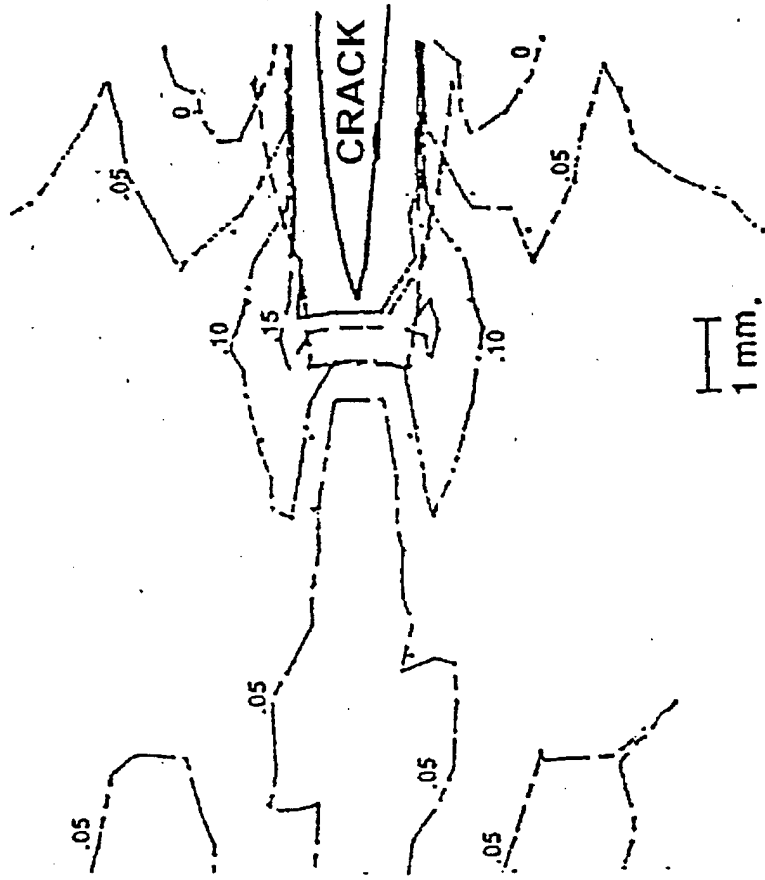
Crosshead Rate = 12.7 mm/min
Global Strain = 0.83%



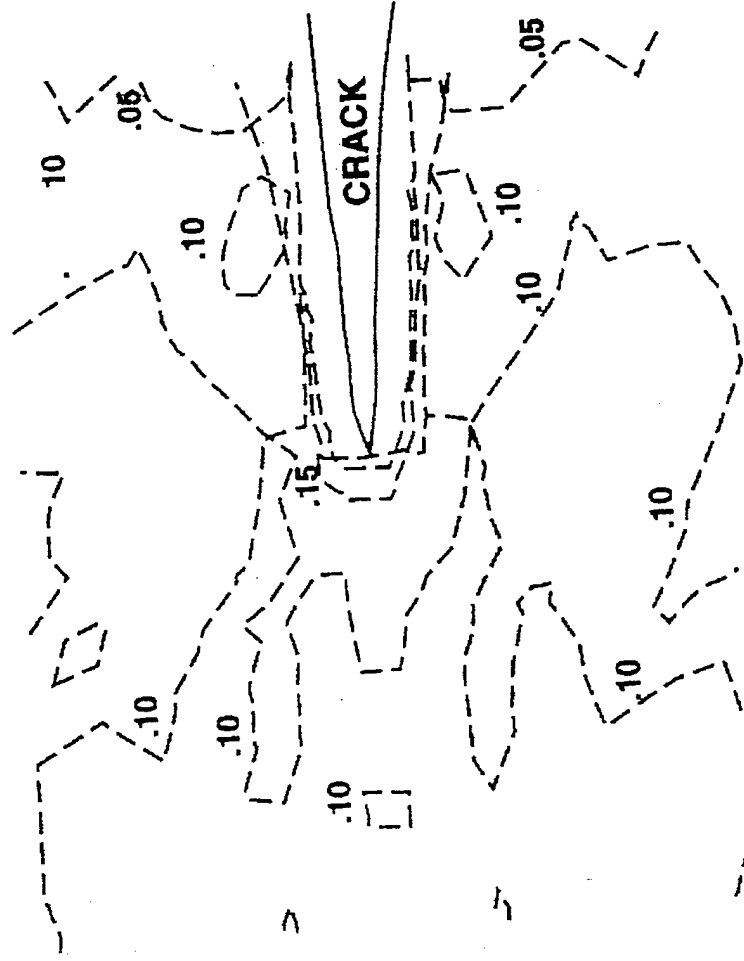
Crosshead Rate = 2.54 mm/min
Global Strain = 0.83%



Iso - Intensity Strain Contours (thickness = 0.5 in.)



Crosshead Rate = 2.54 mm/min
Global Strain = 3.3%



Crosshead Rate = 12.7 mm/min
Global Strain = 3.3%



Conclusions

- For the thin specimen and the thick specimen tested at 2.54 mm/min, the basic crack growth behavior consists of a blunt – growth – blunt phenomenon.
- For the thick specimen tested at 12.7 mm/min displacement rate, a classical brittle fracture occurs.
- The increase in displacement rate alters the local strain fields but the iso-strain contours are of the same general form.
- A power law relationship exists between the Mode I stress intensity factor and the crack growth rate.